16
A084 Prof Hunt. July 26/23
cop. 1

Vol. VIII. APRIL, 1902. No. 8.

The Agricultural Student

A MONTHLY MAGAZINE DEVOTED TO AGRICULTURAL EDUCATION.

5 Cents per Copy. 50 Cents per Year

Gold Medal Awarded

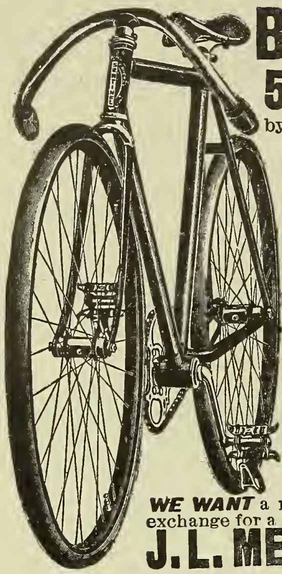
The Improved U. S. Separator

"The KIND THAT GETS ALL THE CREAM."

THE HIGHEST AWARD

at the Pan-American Exposition, Buffalo, N. Y., 1901.

VERMONT FARM MACHINE CO., BELLOWS FALLS, VT.



AGRICULTURAL BUILDING—OHIO STATE UNIVERSITY.

THE AGRICULTURAL STUDENT.

VOL. VIII. OHIO STATE UNIVERSITY, COLUMBUS, APRIL, 1902. No. 8.

TERMS OF SUBSCRIPTION:

One Year	**$0.50**
One-half Year	**.30**
Single Copies	**.05**

While this magazine is published with the approval of the President of the University and the Officers of the College of Agriculture and Domestic Science, the editors are responsible or the statements in all unsigned articles.

Address all communications to the Business Manager, Agricultural Student, Columbus, Ohio.

Entered at the Post-Office, Columbus, Ohio, as second-class matter.

PUBLISHED MONTHLY BY

THE AGRICULTURAL STUDENT

PUBLISHING COMPANY.

M. F. MILLER .... **Editor**

VERNON H. DAVIS .... **Business Manager**

STAFF:

T. L. WHEELER, E. D. COBERLY,

C. A. McCLELLAND, C. H. SATER,

LUCY B. CLAWSON.

CONTENTS.

EDITORIAL CHAT.

The compromise effected in the committee in regard to the Painter bill, which proposes an increase in the University appropriations for the next two years, has given the friends of the University hopes of its passage. The bill calls for an additional tenth of a mill for the next two years to be used for building purposes. A strong fight was waged against the measure by the smaller institution of the state, with the result that a compromise was agreed upon in the committee, making the increase one twentieth of a mill, but fixing this as a permanent appropriation rather than for two years only. The trustees are also allowed to anticipate the levy to a certain extent in regard to the issuing of bonds, so that on the whole, if the measure is passed, the result will be almost as favorable as the original bill.

High hopes are entertained by the University authorities that the bill will be passed.

The University has been especially unfortunate within the last two months in losing two of its most zealous workers. In our last issue we were called upon to announce the death of Mr. Wing, and in this that of Professor C. N. Brown, Dean of the College of Engineering. Professor Brown's death occurred March 6, after only a short illness, caused primarily by heavy work. In his university duties he was noted for his thoroughness and for his incessant labor. His capacity for work was remarkable, and he had accomplished an immense amount of work for one only in the prime of life. The University has suffered a loss from which it will be slow in recovering, and a host of friends and admirers are left to mourn that so useful a man should have been so early removed.

The new board of control of the Experiment Station as appointed by Governor Nash, has entered upon its duties. The personnel of the board shows a wise and conscientious decision by the governor, and we hope the wisdom of the choice, as well as the advisability of the change as a whole, will soon be evident. The board represents well the various parts of the state, being made up of the following representative agriculturists: Friend Whittlesey, Portage County; Alva Agee, Gallia County; O. E. Bradfute, Green County; D. D. White, Erie County; D. C. Sampkson, Hamilton County.

It is believed that the clause of the bill designating that not over three members of the board shall be of the same political party, together with the fact that the members are in no way connected with the station staff, will free the management from political entanglements and give the most efficient control possible.

At the first meeting of the board, Mr. Agee was elected president, and Mr. Bradfute, secretary. Later the recent controversey at the station was carefully investigated, Mr. Thorne unanimously re-elected director, and the resignation of Mr. Webster accepted. Consequently the affairs have at least been adjusted, and in a way that we hope will soon put the station in a position for the most efficient work. The arrangement surely promises well, and we most earnestly hope that there shall be no disappointment in the working out of the plan.

* * * *

The movement that is taking place in the agricultural colleges of several of our states towards a widening of their work to meet the practical demands of the farmer is worthy of consideration. This is a feature of agricultural education, the value of which is becoming more apparent each year. Our agricultural colleges have a duty to perform in the instructing of such students as present themselves, and it is gratifying to know that this number is steadily increasing; but on the other hand, the whole duty of such institutions does not lie in this direction. The farmer who sends his son to an agricultural school is too often the one who needs help the least. It is the farmer whose son remains at home as well as the son himself, who must be reached by other means.

Experiment stations cannot accomplish this, nor can our agricultural papers or organizations. To be sure, these all help in a great measure, but a more direct method should be adopted,—a method with this direct object in view.

Just how this is to be accomplished, may vary in different states and under different conditions. Several states have instituted correspondence schools and reading courses which are proving decidedly effective, and it is probably through some such measures that the most immediate good will come. We

cannot expect to accomplish the end quickly, for whatever means is adopted, there must be a growth. Educational movements of whatever kind are the results of a development. It must be admitted, however, that a direct movement of this sort promises a much more immediate result than the indirect methods. The farmers of our own state are in need of such work, and it is hoped that the time is ripe for such a movement. We urge the various promoters of agricultural education throughout the state to lend their influence towards the initiation of any such methods for agricultural advancement.

Our Southern Phosphate Rocks.

Rich deposits of nodular phosphate are found along the Atlantic coast from North Carolina to the southern extremity of Florida. They do not occur continuously over this region, but in patches ranging in area from a few acres to several square miles.

These phosphates are generally composed of calcareous matter, more or less completely phosphatized, and occur as loose nodules embedded in clay, sand or conglomerate. The nodules usually contain shells, and, frequently, shark teeth and the bones of marine animals.

Whenever a swamp area lies upon a porous limestone or loose marl bed which contains a certain amount of phosphate of lime and has been subjected to a long continued leaching of waters containing carbonic acid gas, and acids arising from decayed vegetation, we may reasonablv expect to find rich beds of phosphatic material. After the evasion of the swamp, we may have the nodules of phosphate like those now found in the vicinity of Charleston, South Carolina.

The two states of special importance in the production of rock-phosphate are South Carolina and Florida.

The South Carolina rock is divided into two general kinds, the "land phosphate" and the "river phosphate." The two varieties do not differ materially in composition, particularly in the content of phosphoric acid. The nodules of the land variety are embedded in a matrix of clay, and these being washed out by rains, work into the stream and form the river deposits. The nodules are irregular, non-crystalline masses and often full of holes, thought to be due to the burrowing of mollusca. The river rock is obtained by the use of dredges, while the land deposits are worked by sorting the nodules from the clay. In either case, they are broken by machinery into coarse fragments not exceeding five inches in diameter, and then passed through the washers to remove all adhering substances. It is then thoroughly dried by kilning or by passing hot air through it, and in this condition, it is ready for grinding or shipment.

There are three principal kinds of deposits found in Florida, the "soft phosphate," 'pebble phosphate" and "boulder phosphate." The soft phosphate resembles clay in appearance, and is largely contaminated with it. Of all the rock phosphates, this one is lowest in phosphoric acid, and highest in oxides of iron and alumina. The pebble phosphate consists of hard pebbles and is distributed over immense areas on the western coast. It makes the bulk of the Florida phosphates. These pebbles vary from the size of a grain of wheat to about an inch in diameter. The boulder, or hard rock phosphate, occurs in the form of stony masses or boulders, large and small. It is the richest of our rock phosphates, containing on an average about 80 per cent.

of phosphate of lime, the equivalent of about 34 per cent. of phosphoric acid.

The South Carolina deposits were first worked in 1868, and up to the present time have formed the most important supplies of the world. In 1888 the Florida deposits were found to have a great commercial value; and since that time, such great progress has been made in their development, that they have exceeded the South Carolina deposits in annual production and value. While the production of the South Carolina rock is now decreasing, that of Florida rock is rapidly increasing and will doubtless be our chief source of rock phosphates in the future.

Deposits thought to have been derived from a highly phosphatic limestone are found in Tennessee. These do not occur in nodules, but in soft, porous plates of various colors. The rock phosphates used in the Central States are, perhaps, mostly obtained from this region.

Phosphate rock can not be used as a fertilizer in its natural condition, as the phosphoric acid is then almost totally unavailable. After it is washed and dried, it is pulverized, in which form it is known as phosphate flour. It is then placed in lead-lined tanks and treated with commercial sulphuric acid. The amount of acid used depends upon the composition of the rock; but ordinarily a ton of high-grade phosphate rock requires a ton of sulphuric acid. The material is mixed by a strong mechanical mixer, and allowed to stand a few days for the completion of the reaction, after which the mass is ground and sold as "superphosphate" or "acid phosphate."

C. A. McC.

Some Important Scale Insects.

Among the many families of insects with which the fruit grower has to contend, none are of more importance than the bark-lice, or scale-bugs. They belong to the family of Coccidæ. There are three sub-families found in the United States which are of considerable economic importance. They are Coccinæ, Lecaniinæ, and Diaspinæ. The Coccinæ includes the forms known as "mealy-bugs." These insects do not produce a scale, but are covered with a white, waxy secretion, which gives them this name. They are the only forms of insects found in this family that are free throughout their life period. They have no wings and are one of the most obnoxious of greenhouse pests. They are of tropical origin, and in the warmer regions infest plants in the open air.

The Lecaniinæ differ from the above in having a hard scale like covering, which is attached to the body, forming part of the body wall. They are found in some parts of the country on plum and peach trees. The body is hard and hemispherical, of a dark brown color. Reproduction is by means of eggs. The female winters in an advanced stage and produces eggs during the month of May. These begin to hatch in June and the young wander out upon the twigs and attach themselves. The males mature in the latter part of July and are fitted with one pair of wings. The females retain legs and antema, though remaining fixed to the tree after attaching themselves.

The Diaspinæ, or armored scales, are fixed forms, the scale being formed of the moulted skins and a waxy secretion from the pores in the insect's body. As soon as the young are produced they leave the parent scale and moving out upon the branch become fixed by inserting the sucking mouthparts into the tissues of the plant. The scales are produced soon after the insect becomes attached. The scale is not a part of the body wall, but is free from it, forming a protection for the insect beneath. The shape and character of the scâle is of importance in the classification of the different genera, but the characters used in classification of the different species are found in the last segment of the body of the female insect.

The majority of species of scale insects at present found in the United States are not indigenous to this country, but have been introduced from abroad, most of them from European regions, on plants and young trees and fruit carried to this country in the course of commercial interchange.

One of the most destructive insects in this family, and which has received more attention than any other, is the San José scale, Aspidiotus perniciosus. This is more widely spread, and has a wider range of food plants than any other scale insect in the United States. It may be identified by the shape and appearance of the scale, which is circular with the exuvia, or moulted skin ,at or near the center, and darker than the surrounding scale body, which may be light gray or white. The male scale is similar to the female, but much smaller. To be safe in determining a suspected scale, they should be examined under a microscope for the characters of the anal segment. Unlike most species of this family the San José scale is viviparous. It passes the winter as a half-grown or nearly full-grown female, and about the middle of May begins to give birth to living young, and continues to do so, day after day for six weeks. As soon as the young larva is produced it wanders about until it reaches a favorable spot, when it inserts its beak and becomes fixed, and within forty-eight hours begins the secretion of its scale. This secretion is white and fibrous and the insect becomes invisible in about two days. The female becomes full grown in thirty days, the males maturing in twenty-four. At about forty days after birth the females begin to give birth to another generation. While the females are wingless, and, after forming the scale are also legless and eyeless; the males on the other hand are provided with a single pair of wings when they issue from their pupa stage at twenty-four days. They have no mouth parts, but are provided with eyes in the position that the mouth would occupy. They live only for a short time after coming from their scale. There are four or five generations produced annually. From accurate observations of a series of experiments made by the Department of Agriculture at Washington, it was estimated that if all the young from one over-wintered female should live, the increase from this one and her progeny for a single season would be over 3,200,000,000. These would be the descendants from a single insect in a single season if all filled their functions in life. While it is hardly to be expected that all should live, yet, granting that a goodly number should perish prematurely, even then it is readily seen that enough survive to explain the sudden destruction of trees attacked. As to the number of individuals produced by a single female, observations show that nine or ten are brought forth every twenty-four hours, which would make a

total production of about four hundred during the six weeks.

Another species closely allied to this scale, is the "cherry scale," Aspidiotus forbesi. Its appearance to the naked eye is very similar to the San José scale, but one difference is in their habit of life. This scale inhabits the trunk of the tree, frequently seeking refuge under the loose bark, making it possible for it to exist for a long time unnoticed. The San José on the other hand prefers the twigs and outer branches. The specific differences are largely microscopic. This species reproduces by means of eggs. The main reason that the San José is more destructive than the many others is in its method of reproduction, and in being found in the living condition at all times of the year, continually feeding on the plant. The only means of distribution for any considerable distance is by being carried on living plants, or parts of plants which may retain their vitality, such as cions for grafting. The means of becoming spread in a locality from an infested tree to others surrounding it would be by the wind, or on the feet of birds. In orchards, where the limbs of the trees interlace, its spread would be very easily understood. The San José scale occurs on most all woody plants except orange, lemon, and the pines. Its original home is probably in Central China. The "cherry scale" is so-called on account of its showing a preference for cherry trees, although it is not confined to this alone.

Another well-known scale, is the oyster-shell bark louse, Mytilaspis pomorum, which is found in all parts of the world. It probably originated in Europe and was imported into this country on nursery stock by early settlers. The first American account of this insect was published in 1796 by the Massachusetts Agricultural Society. They are very commonly found in all orchards on apple and pear trees, being more abundant in the northern than the southern States, but it is by no means confined to these trees alone, as it is found upon several other species, notably the lilac. The scales differ very much in appearance from those of the Aspidiotus. They are elongated, with the exuvia, or moulted skins, at the anterior end, growing wider as it extends backward. In form they resemble somewhat a minute oyster shell, from which the name arises. They are ash-gray in color. The length of the scale is about four times the width. The male scale resembles the female scale, but is much smaller. The insects are reproduced by means of eggs, and do not multiplyfi therefore, so rapidly as the San José scale. There is but one generation annually. The female produces eggs and dies in the early winter season, and if, during the winter one of the scales be lifted very gently with the point of a needle there will be found in the anterior end the shriveled body of the female, with from forty to one hundred yellowish-white eggs packed close behind it. In the Northern States these eggs will hatch in the latter part of May or early in June, wander out upon the twigs and settle in a short time. The young twigs are the only parts of the tree seriously affected. As soon as located the young insect begins to feed on the sap and produces the waxy covering which makes the scale over it. As the insect grows and moults, the scale is also enlarged. There are two moults of the skin before the insect becomes full-grown, and is ready for reproduction. They differ from north to south in that there are two generations annually in the south. From their manner of reproduction they are not so limited in their means of spreading as the San José scale, as they can be carried on dead material in the egg stage without interferring with their power of reproducing

the species if brought upon, or near, suitable food plants when hatched.

Another species closely related to this is the pine leaf scale, Mytilaspis pinafolia, which is found on the leaves of the white pine, but is not confined to this species alone, as it has been found on other species of the same family. In life history and habits it resembles the above. The scale is light gray or white and is found in the grooves of the leaves of the pine, its shape depending much on the leaf. If this scale be lifted in winter it will be found to contain beside the dead female a large number of reddish eggs packed around the body. In some instances a small hole will be noticed near the posterior end of the scale which is evidence that it has been visited by one of the minute parasites which prey upon these pests. In such cases the scale will be found to have but very few eggs under it.

Theo. W. Ditto.

Pasteurization of Milk.

Pasteurization is a process that is not as fully understood by dairymen as it should be, neither in its importance nor the manner in which it should be done.

The process derived its name from Pasteur, an eminent French chemist, who first used it extensively.

A great many people mistake pasteurization for sterilization. There is a great difference when the two processes are compared. In pasteurization the milk is submitted to a heat ranging from 140° F. to 175° F., for ten or fifteen minutes, while in sterilization the temperature ranges from 250° F. to 270° F., for from one to two hours. This makes it perfectly sterile, that is, kills all germs both in vegetative and spore form; while in pasteurization only those organisms that are in a growing vegetative condition are affected. But if the milk is quickly cooled, it enhances the keeping quality very materially. Experiments have been made showing that when stored at 86° F., properly pasteurized milk will remain sweet from six to eight hours longer than raw milk. At 77° F., ten hours; at 73° F., twenty hours; at 58° F., from fifty to seventy hours.

Pasteurized products should possess the following requirements: (1) Absolute freedom from disease bacteria. Most all the disease bacteria that are apt to be transmitted by milk (tuberculosis, typhoid, diptheria, etc.) do not form spores, so that proper pasteurization will free the milk from these diseases.

(2) Ordinary milk bacteria should be diminished; that is, acidi lactici, the bacterium that causes the souring of milk, should be lessened in number.

(3) Improved keeping quality. By killing all the vegetative forms and then cooling the milk and keeping it cool, the spores do not germinate and form new bacteria.

(4) Normal in taste. Pasteurized products should have no perceptible cooked taste. This is something to be guarded against and is one objection to sterilized milk. When milk is first pasteurized, there is a cooked smell to it that is very disagreeable, but this disappears in cooling. Even if the milk has been pasteurized and does not have a cooked taste, there is something about it that is not very agreeable in warm weather. At least that has been the experience of many. As soon as warm weather sets in, people begin to demand the unpasteurized milk, claiming that the children do not like the pasteurized product.

While the pasteurizing process is an exceedingly simple one, yet in order to

secure the best results, certain conditions must be rigidly observed in the treatment before and after the heating process.

It is a mistaken idea that any milk is fit for pasteurizing. The fresher and better the milk, the less likely it is to contain deleterious spore-bearing bacteria. The milk should be as clean as possible, and for high grade pasteurizing, it is advisable to purify it by passing it through a separator which removes most of the organic matter. Pasteurizing as applied to the preservation of milk, originated in Germany and Denmark, where it is used largely in the treatment of skimmilk and the heating of cream in butter making.

There are two kinds of machines used. (1) The continuous flow machines, and (2) the intermittent machines. The Reid is a type of the former, and the Potts' pasteurizer a type o fthe latter. Pasteurizing involves considerable time and trouble, and it is better not to have the process done at all than to have it imperfectly performed. This is one trouble with dairymen who imperfectly understand the process. They may get the milk properly pasteurized and then run it through pipes that are not clean, and thus contaminate the milk again and make it worse than before.

When a person is getting milk from several different places and does not know how it has been handled, then pasteurizing is a good thing; but when it is from good, healthy cows, and when it is cared for in a cleanly manner, pasteurization is an unnecessary process.

"Cleanliness" should be the motto of every dairyman, for surely "Cleanliness is next to Godliness" in the dairy business.

T. L. WHEELER.

Chrysanthemum Rust.

Chrysanthemum rust is closely related to hollyhock, carnation or asparagus rust. When badly infested with the rust, the chrysanthemum plant becomes dwarfed, the leaves small, and brown upon the under side. Later on, instead of the green color of healthy plants, these are small, stiff, nearly leafless stems, ending in stunted heads, that fail to open into marketable flowers. Over all the lower portion of the plants is a brown powder, as if they had been sprinkled with tobacco dust. When closely examined, the plants are found to have on the under surface of the leaves, brown spots or blister-patches, slightly raised, and covered with a dust that readily rubs off. Such leaves are more or less irregularly discolored, so that the presence of the rust may be detected by the coloration of the leaf, as seen from above.

The rust in question is due to a fungus, as before stated, which is probably Puccinia Hieracii, Mart. As yet, however, the form of spore for a full determination has not been observed upon the American plants. This fungus consists of microscopic threads which grow through the substance of the plant, feeding upon its juices, and finally breaking out through leaf or stem, bear the innumerable brown spores that give the dark color to the affected parts. These spores are borne by the winds, or driven by the water from the hose, to other plants, where they germinate quickly and spread the disease.

Treatment.—The chrysanthemum rust has been known in this country for only a few years, it having first come to attention of authorities about 1896 or 1897, and therefore experience with remedial measures is here quite limited. We may, however, profit from the treat-

ment it has received in Europe. One English grower, who doubtless is writing out of his sad experience, says: "Every gardener should be careful where he obtains cuttings and plants, otherwise he may quite unwittingly introduce the rust in his collection." It is of prime importance that the stock used for propagation be free from the disease and all purchased plants likewise. In addition, the plants in all stages of growth, from the beginning, should be sprayed weekly with Bordeaux mixture, or other equally effective fungicide. The rust should be watched for upon the older leaves, and when first met with, all foliage showing the least signs of the rust should be destroyed. If the disease increases, it may be best to burn the whole lot, fumigate the premises, and start anew, with fresh, clean stock.

This is an enemy that has proved its ability to strike a death blow, and it should be watched for, and, when found, destroyed. It may be that some varieties of chrysanthemums are not easily attacked, and these are to be noted and made use of accordingly.

There is no danger, as some have feared, of this rust spreading to carnations or other plants outside of the chrysanthemum group. It does attack some of our wild plants, and it is barely possible it came from them to the chrysanthemum. E. D. C.

Miscellaneous Notes on Corn Smut.

Corn smut (Ustilago zeal (Beck) Ung) has been known to the civilized world about 150 years as indicated by the earliest descriptions, but comparatively little was known of the real character and habit of this fungus until quite recent years.

The fungus was not at first recognized as a distinct plant growth, but was thought to be simply an abnormal growth of the corn plant itself. Various causes, such as too rich food, too close planting, insect stings, etc., were thought by different investigators to be capable of producing such a growth.

About seventy years ago smut first became recognized as a fungus with distinct form and habit, and, although quite thorough investigations were carried on from time to time, these were undertaken upon the theory that corn smut, like the smuts of the smaller grains, infected the plant through and by means of the seed. It remained for a German botanist, Brefeld, within the last fifteen years, to place future investigations upon a proper basis.

As Brefeld has very ably shown, the habit of this fungus is very radically different from that of most other smuts, and is in general terms essentially as follows:

The dark brown mass of corn smut as we may find it now, buried under the snow or still clinging to the dry cornstalk, is almost wholly composed of minute spores covered with slight projections. The diameter of an average spore is approximately 1-2500 of an inch. In other words a ball of smut two inches in diameter, even if the spores actually occupy but one-fifth the entire space, contains over twenty billions of spores. Figures show that fifteen such smut masses could have furnished one spore to every stalk of corn grown in the United States in 1900.

As the smut dries out from time to time, the spores become loosened and float about here and there like fine dust. Settling finally upon some moist surface or in a crevice, they lie dormant until suitable conditions are at hand for germination. Among the conditions helpful to germination the most requisite are warmth, moisture, and soluble

food material. Very little or no germination takes place in pure water, but, as Brefeld found, a solution of barnyard manure is one of the very best fluids for this purpose.

Once the conditions are suitable, the spore quickly germinates by throwing out a thread (pro-mycelium) consisting usually of four rather elongated cells. From the end and sides of these cells arise smaller, more or less spindle-shaped spores (conidia), which are formed very abundantly if the pro-mycelium is exposed to the air. These last formed spores or conidia are the real source of infection. Floating about in the air even more readily than the first mentioned spores, they may perhaps be carried miles before finally coming to rest. If the final resting place happens to be among the uncurling and rapidly-growing leaves of a young corn plant, then all may be well with the fungus. In the presence of a little moisture, dew perhaps, the conidium germinates and by sending out a long slender thread (infection thread) it penetrates the tender tissues of the young corn plant.

Having once gained entrance, the threads grow rapidly, sending meanwhile short knobby branches into the cells of the corn plant after food.

Feeding and growing in this manner, the fungus ultimately fills the infected portion of the plant with a densely matted growth of threads and at the end of ten to twenty days after infection, there appears a swelling having at first a glistening white, membranous covering, but finally developing into the dark-brown, greasy mass we call smut. This consists simply of the threads of the fungus broken up into short, round, and specially covered joints or spores.

As soon as the new spores become dry enough to be blown about in the air they are capable of germination, and so it comes about that there are several generations of smut during the same season.

If, in floating about, the conidia alight upon older and more or less matured parts of the corn plant instead of young growths, as mentioned above, the chances for infection are very slight indeed. The infection-threads are unable to penetrate the harder, more mature tissues and so the fungus perishes. In large corn plants only such tender growing parts as the brace roots, the leaf-sheath bases, the tassels, and the young silks are very susceptible to infection. It is probably safe to say that nearly all infections of the ears take place through the young silks.

If, on the other hand, as has been shown in the last few years, the older tissues are laid bare by mutilation, there is a good chance for infection to take place.

At the Illinois Experiment Station a plat of detasseled corn showed 60 per cent. of the total smut to be at the point where the tassel had been removed. Three plats mutilated by tearing open the husks and somewhat mutilating the ears gave 103 smutted ears out of a total of 199 ears, or over 50 per cent. The corresponding check-plat, on the other hand, showed but one smutted ear.

At the Kansas Experiment Station in 1899 in connection with some pollination experiments, the partly developed ears had been chopped off with a corn-knife early in the season, and ears appearing later allowed to develop unmolested. In this plat 117 stalks had borne ears, of which ten had been chopped off. Of the ten cut ears, nine were smutted (90 per cent.), while of the 107 uncut ears, five only were smutted (4.7 per cent.).

Experiments at O. S. U., carried on in 1901 along this line, and involving 3357 stalks were reported in detail at the 1901 meeting of the Ohio Academy of

Science, showing among other things the restriction of a relatively large percentage of the total smut to the limited areas subjected to mutilation.

Conditions favorable to the growth of corn are generally favorable to spore germination as well. A few days of moist warm weather during the growing season has been found to be followed in [1]about ten days by a sudden increase of smut pustules. Corn on land holding more moisture or more heavily manured, is found more largely smutted. Also corn planted early, and thus offering a longer season of growth during which infection may take place, has been found more heavily diseased.

As to the prevalence of smut, counts at the Kansas Experiment Station in 1899 showed the percentage of diseased stalks in different fields to be respectively 10.7 per cent., 20 per cent., and 27 per cent. In 1895 the Indiana Experiment Station found the percentage of smutted stalks in corn fields in the vicinity of Lafayette, Ind., to range from 3 per cent. to 12 per cent. The river bottom corn at O. S. U. showed in 1901 over 9 per cent. of the stalks to be smutted.

The actual decrease of value of total crop, attributable to smut injury, has been estimated at the Illinois Experiment Station to be from .5 to 5 per cent. The Kansas Station found in this connection, that the ears were damaged five times more than the stover,—as indicated by the comparative weights of healthy and smutted stalks.

As to the practical side of the question, a general knowledge of the life history of corn smut gives us at once a foundation upon which to base efforts toward destruction and prevention of the disease.

Since the plant is not infected through the seed, any treatment of seed corn as a preventive measure is utterly worthless. This has actually been found to be the case in a large number of experiments. As was mentioned above, experiments until quite recently have had as their basis the theory that corn smut, like the smuts of smaller grains, infects the plants by means of spores clinging to the seed or occurring in the soil with the seed; but attempt after attempt failed to show any increase of smut whatever by planting seed rolled in smut. Likewise all attempts at controlling smut by the various methods of seed treatment found more or less effective in the case of the smaller grains, were utter failures.

Smut is receiving just the conditions for its best development by being thrown out into the barnyard or upon the manure heap, and this should not be done.

At the Kansas and Indiana Experiment Stations[1] different fungicdes, such as Bordeaux mixture, chloride of iron, sulfide of potassium, and ammoniacal copper carbonate, applied as sprays during the growing season, have been found to reduce the prevalence of smut 50 per cent., or even, in some cases, 75 per cent.; but best results require several sprayings during the season, and, excepting in extreme cases, the practice can hardly be said to be a profitable one.

From what is known of the effect of mutilation upon the prevalence of smut, it is easy to draw therefrom the lesson that care should be taken in the cultivation of corn not to needlessly mutilate the plants.

Probable damage from smut is also a factor to be considered in the problem of when to plant corn. A later planting may, by reason of less smut, be in some cases a wise thing.

In view of our present knowledge of corn smut, a more thorough acquaintance with the subject and more careful consideration of the problems involved

in dealing with the smut, would seem desirable for the average farmer. Details of corn culture which influence the value of the crop much less than does corn smut, are often made the subject of private experiment and are more generally known by farmers, and so it seems quite reasonable to urge a more general attention to the subject than prevails at present.

OTTO E. JENNINGS.

The Food Principles, Their Sources and Uses in the Body.

A food is that which goes directly or indirectly to assist in the growth and repair of the body and to produce heat and energy. Foods are divided into the following elimentary principles:

1. Nitrogenous.
2. Carbohydrates.
3. Fats.
4. Mineral.

A healthy and suitable diet must contain, (1) the proper amount and proportion of the various principles; (2) it must be adapted to the climate, to the age of the individual and to the amount of work done, and (3) it must have the principles present in digestible form.

The nitrogenous compounds form and repair muscle, brain and nerve tissue, yield heat and energy and regulate the absorption of oxygen. They are composed of carbon, hydrogen, oxygen, nitrogen and sulphur, and form the most important constituents of the body. This class of foods is acted upon in the stomach by the gastric juice and converted into peptones which can be absorbed; portions not changed in the stomach are converted into simpler substances by the pancreatic juice. Man derives this food largely from the animal kingdom, as meat, milk, eggs. It is also found in peas, beans and lentils. The muscular and connective tissue of certain animals is the most concentrated and most easily assimilated nitrogenous food; some fat is found in it, especially in pork, which accounts for its indigestibility, the fat preventing the gastric juice from obtaining ready access to the muscular fibres.

Beef is considered the finest meat, both on account of its flavor and its stimulating and sustaining qualities. Veal is less strengthening and less digestible than beef.

Mutton is closely allied in its nourishing properties to beef; its fibre is shorter and finer, which makes it somewhat more tender. The lean is more digestible than that of beef, but fat is less so. Milk contains all the elements that are required for the growth and maintenance of the body, except that it is deficient in the mineral salts when taken as food for a grown person.

The nutritive value of eggs is high, as they are so readily digestible, but the more eggs are cooked, the more insoluble does their proteid become.

Dried peas and beans contain a large amount of nitrogenous matter, but they are not so easily digested as meat. Green peas are more digestible, but less nutritious.

The carbohydrates include the starches and sugars and are composed of carbon, hydrogen and oxygen; they are found chiefly in the vegetable tissues. This class gives heat and energy and forms fatty tissue.

The starch molecules are complex, the granule varying in size and form, each consisting of a central cleft about which are found concentric layers of starch and cellulose. Starch is insoluble in cold water, while boiling water bursts the cellulose envelopes and so allows the digestive juices to get at the starch; thus digestion may be said to commence in its preparation by cooking. The saliva

acts upon the starch, changing it to glucose, a variety of sugar; it is not affected in the stomach and that which has escaped change in the mouth is changed to sugar in the small intestine, and thence absorbed into the blood. Starch occurs abundantly in the cereal grains, especially rice, Indian corn and wheat; also in potatoes and many of the succulent fruits.

Flour contains all the constituents found in wheat, but in quite different proportions, since much of the germ, cellulose, ash and fat are removed to insure a better product for the market. It is estimated that 96 per cent. of good white flour is digested. The whole wheat flour contains 1 to 2 per cent. more protein than white flour, but there is a larger amount of indigestible material.

Potatoes when well cooked are easily digested. The nitrogenous substance as in wheat is just under the skin and a good deal is lost in peeling before cooking them. The salts dissolve in water and are lost more in boiling than steaming. Steamed or baked in the skins, potatoes are more nutritious than in any other way.

Fats are also composed of carbon, hydrogen and oxygen, but in a different proportion from that found in the carbohydrates. Their use is to form adipose tissue, to help retain the heat of the body and to give heat and energy. They may be reabsorbed by the blood during abstinence from food. The power of the fats to maintain the heat of the body is two and one-half times that of starchy foods. In digestion the fat globules are freed in the stomach from the proteid tissue, divided into minute particles, forming an emulsion, absorbed by the villi of the small intestine, and on reaching alkaline blood may be saponified.

Oils, beef fat, crisp bacon, suet and cream are the most digestible fats. Pork fat is the most indigestible.

Inorganic or mineral substances, under the forms of water and certain saline principles, constitute an indispensable part of a living being and hence must enter into the composition of the food. Water is the carrier of the food into and through the system and forms more than two-thirds of the whole body. It is contained in all solid foods as well as in the liquids.

The salts are found in the drinking water and all animal and vegetable foods, and consist of sodium and potassium chlorides, calcium and magnisium phosphates and iron compounds. They are used in building the bony stricture of the body, they supply chlorine for the hydrochloric acid of the gastric juice, and are needed for the nourishment of hair and nails. Salts are found in small quantity in almost all foods, with the exception of sodium chloride which is added in the form of salt.

These alimentary principles serve different purposes in nutrition, and although to some extent the members of one group may replace those of another, a combination of all is necessary for the maintenance of the body in perfect health.

L. B. C.

Lameness in the Horse.

The function of locomotion of an animal might be classed as being performed by two principal systems, or organs; the muscles performing the active portion and the bones the passive portion of the movement. Then it is very necessary that a co-operation between the two exists, and this is effected by means of a contact of

the muslces with the bones. The muscles attach themselves to the bones at various ponits, sometimes eminences or depressions, sometimes a border or an angle, or it may be a mere roughness of the surface of the bone. With this the muscles are endowed with power of contraction or relaxation, or better said, flexion and extension. By this means the various movements are produced, and by the combinations and the rapid alterations of these movements the various gaits result. Any interruption or derangement of any kind, of any of these movements, constitutes the pathological condition of lameness.

Lameness ocurs in all animals, but in consideration of their usefulness to man that of the horse and ox are of most importance.

The horse being used, as he is, as a beast of burden, is exposed the most to danger, and accidents, which make him more liable to become lame.

Lameness is a condition never very hard to detect, but the difficulty comes in determining which leg is affected. In order to determine this, the animal should be examined, first at a slow walk. This examination should be done from each side, and from before and behind. Then by carefully watching as he approaches and recedes the observer can always determine, the drop of the body to the sound side, or to the sound limb. For example, an animal lame in the right fore leg, will drop on the left fore, or if lame in the left would drop on the right. After the observer has the lame leg located, two more difficult questions arise, first as to which region is affected, and second as to what structure is affected. By noting the manner in which the lame leg performs its functions, by carefully watching the movements of the whole extremity (especially the joints which enter into its structure), by carefully examining every part of the limb, observing the outlines, testing the changes if any, and by noting the state of sensibility, an observer with a little experience and practice may be led to the correct localization of the trouble. But with all this, a hasty conclusion or diagnosis should be avoided until a very thorough and minute examination of the foot has been made. Of course the seat of lameness may have its location somewhere along the course of the limb, but from the very great liability to injury, the foot should always be considered first in making a diagnosis, and the diagnosis should never be made without an examination of the foot. In making this examnation first, the seat of a majority of the causes of lameness is located, and this often does away with an embarrassment on the part of the examiner. As before stated, the foot of the horse is very liable to injury, and it would be well to mention the most common causes liable to produce lameness. Perhaps the most common cause is from street nails. The animal in traveling the streets picks them up, drives them into the deeper tissues, and lameness results. Nail pricks also are common, resulting from nails being closely driven, or driven into the sensative layers of the horn capsule, at time of being shod. Calk wounds also produce lameness. These occur at various points, usually, however, near the coronet or upper portion of the hoof capsule, and are usually caused by some accident. Bruising of any portion of the foot is also common, and usually the bulbs of the heels or frog is affected. Corns are very common, usually in the front feet, and at the base of the sole. Founder and seraphyllocele produce lameness also, the former being diagnosed by the peculiar way the animal

walks on the heels. Seraphyllocele are horny tumors extending the whole length of the wall, and they may or may not cause lameness. C. H. S.

Agricultural Education.

Nothing speaks better for the future of the country as a whole than the rapid development that is being made in agricultural education. Each year marks an advancement in the methods and means of promoting this line of work, and each year shows an increased interest by the agricultural masses in this improved agriculture. And it is not only among people of the rural communities that this interest is increasing, but among those of the cities and towns. Every year an increasing number of business men are looking to the country for opportunities for profitable investment as well as a source of enjoyment. People have been flocking to the cities. Now the pendulum seems to have finished its swing and to be on the verge of starting back, or is at least making an effort to restore equilibrium. If this movement increases, as it undoubtedly will, we can expect much good from it; although it is not to people of this sort that we must look for the fullest development of agriculture. We can expect from it, however, a certain uplifting of the agricultural pursuit in the eyes of those who have so long looked upon it with a feeling of contempt, together with an instilling into the methods of our agriculturists something of the business principles characteristic of the merchant or manufacturer of the city. The uplifting of agriculture in the eyes of the masses is being accomplished to a very noticeable degree. Views are changing and people are looking at various things in a much more practical, common-sense sort of a way than formerly. Agriculture is coming to its own.

There are several factors responsible for this advancement, but none more important than the persistent and combined efforts of our agricultural colleges and experiment stations; and it is to these that we must look for the greatest advancement in the future. Their methods of work then, constitute the most important factor. Conditions are favorable for rapid advancement in methods, and the opportunity should be grasped.

A paragraph from the editorial notes of the last Experiment Station Record reads as follows: "We have outgrown the notion that a farm and a professor of agriculture are sufficient means for the promotion of agricultural education in our colleges, and it were well that this should be universally recognized in practice as well as in theory. Data in considerable amount have accumulated, showing that where a strong faculty of specialists in different branches of agricultural science is organized, and arrangements are made to meet the varying needs of students by special agricultural courses or schools, it is not difficult to gather in a considerable number of students and to increase materially the number who will elect to take the complete college course in agriculture. It is also pretty well recognized that institutions for agricultural education have not done their full duty until they have strenuously endeavored to widen their base of operations by extension work through farmers' institutes, correspondence courses, etc., with a view to arousing their agricultural constituency to the importance of technical training in their art and the opportunities which such training opens up, and thus laying a broad foundation for sucessful college courses in agriculture."

The reference here to the work among the farmers directly, brings out a feature which has been neglected to a great extent in many of our educational institutions. The farmer is of a peculiar nature, reqquiring in many cases that his education be almost forced upon him, and this must be done by means of institutes, correspondence schools and reading courses. There are thousands of farmers in every state who do not consider it worth while to send their sons to an agricultural school, yet who would gladly take advantage of an opportunity to learn, and have their sons learn, if it were presented directly.

Several of the states have taken up work of this sort and are meeting with success. The interest in this feature of the work is much greater than ever before, and it remains for each state, through its agricultural college or otherwise, to adopt some such measures for the help of the farmers who are not now reached by the agricultural college. We must not rest on the laurels that have been won in the advancement of agricultural education, but make it only the basis of this wider and more complete work. We should combine our efforts and seek in every way the furthering of agricultural education and improved methods among the farmers of the country.

Oat Smut–How To Prevent It.

Farmers who grow oats know how much grain is at times destroyed by smut; the amount of smut ranges from almost nothing to one-third, or in extreme cases even one-half, the entire yield. On an average it is computed that this loss is not less than 6 per cent. of the annual Ohio oat crop, or $450,000 to $500,000 each year. This loss is practically all preventible by a simple method of treating the seed oats to kill the smut spores that are sown with the seed only, and the Experiment Station has proved this method to its entire satisfaction. This is known as the formalin method of Bolley. Formalin is a clear liquid, a solution of formaldehyde in water, and may be purchased at drug stores for about 50 cents per pound. Each pound is sufficient to stir into 50 gallons of water and will treat 50 bushels of seed oats; 1 ounce is enough for 3 gallons of water and will treat 3 bushels of oats. The amount purchased will be determined by the number of bushels of oats to be treated. The formalin is not poisonous, though not wholesome; it is well to avoid smelling of the strong solution as purchased, because it is irritating to the nostrils. The very dilute solution used for oat smut is not objectionable.

TO TREAT SEED OATS FOR SMUT.

Having the solution made at the rate of 1 ounce of formalin to three gallons of water, well stirred, and a gallon of solution to each bushel of seed to be treated, apply this with a sprinkling can to the oats in piles on a tight floor. Grain piles should not exceed about six bushels and the number of piles will follow from the amount of seed. Sprinkle each pile in turn, shovel thoroughly, and continue in each case until the solution tends to run out on the floor despite the shoveling. Usually a half gallon or more per bushel may be sprinkled on the first round, when the one pile is passed for a few minutes while another is handled in the same way. Upon a second sprinkling of each pile as much solution is used as will be held; then with a third or fourth repetition the gallon per bushel may be used. After this, shovel over and leave in low flat piles over night, or for not less than four hours. The seed may then be spread thin on a floor and shoveled over occasionally to dry out for

drilling, or it may be sown wet if broadcasted. If in weather when proper drying of the seed is secured, the treatment may precede the time of sowing by some weeks. Seed treated in this manner is not poisonous, though scarcely suitable to be fed to horses.

TO PROCURE FORMALIN.

The Experiment Station has no pecuniary interest in commercial transactions, but an easy and reasonable acquisition of the formalin may advance the Station's teachings. Learning that some have been unable to purchase formalin near at home, the Station has arranged to have local drug firms fill orders at the following rates, if orders are sent to the Experiment Station. It is preferred that purchases be made at home. One oz. bottle of formalin by mail 15 cents; 2 oz. bottle by mail 25 cents; 4 oz. bottle by mail 30 cents, postage in all cases prepaid. By express ½ pound formalin 35 cents; 1 pound, or pint, formalin 40 cents, expressage paid by recipient. Remittances should be made to the Station.

The Station Botanist is also director of this line of experiments in the Agricultural Student Union of Ohio, and will be able to supply formalin upon agreements to conduct experiments and report results, to one or more persons in each township of the state. Applications in this line for experiment may be addressed to the Station Botanist. Other requests, remittances or inquiries should be addressed to the

EXPERIMENT STATION.

Wooster, Ohio.

—Press Bulletin.

The wonderful increase in our exports of farm machinery to foreign countries is a feature that shows the development of the country. In the early nineties, the value of these exports amounted to about $4,000,000, and in 1901 it had increased to $16,000,000. Among the large buyers are Brazil, Argentina, Russia and Australia. That we must meet the competition of these countries in agricultural products is evident, since they are importing these machines for use.

Agricultural College and Experiment Station Notes.

Oregon Agricultural College is to have a new agricultural building. It is to be 85 by 125 feet and three stories in height.

* * * *

The new experiment station of Porto Rico reports considerable injury to crops from wind and rain. The northern crops are suffering badly from fungus diseases and insects, while the native crops are doing well.

* * * *

The New Mexico station is endeavoring to give its bulletins wider circulation, and is publishing the more popular ones in Spanish.

* * * *

The new laboratory building of the Department of Horticulture of the Iowa Agricultural College was formally opened Saturday evening, February 22.

* * * *

William Le Roy Brown, president of the Alabama College, and chairman of the station council, died January 23, in his seventy-fifth year.

* * * *

J. D. Towar, agriculturist of the Michigan station, has accepted a position as government professor of agriculture in South Australia. Besides the usual duties devolving upon a professor of agriculture, he will be required "to advise the government on all points relating to agriculture."

Beautifying the Home Grounds.

The old-fashioned gardens of half a century ago, with no thought of effect, gave decorative plants their proper position by relegating them to some corner or border location. Often times they were planted near the old-fashioned well-sweep with a clump of trees beyond, simply because they grew so thriftly there under the frequent dashes from the old well bucket. Naturally they form a picture still fresh in the memory of many a wanderer from the old homestead, who is now shut in by towering walls of brick and stone. Some of the pleasing effects that one can arrange in planning the home garden are indicated in the April Delineator, where the directions are given by a well-known authority on gardening.

Book Reviews.

FUMIGATION METHODS.—A timely work for farmers, gardeners, nurserymen, fruit growers, florists, millers, grain dealers, transportation companies, college and experiment station workers, etc. By Professor W. G. Johnson. Cloth. 300 pp. Illustrated. Orange Judd Company, New York. Price, postpaid, $1.

This book is the first of the kind ever published, dealing with a subject which although somewhat new, has come to be of great importance to fruit growers, florists, grain dealers and others. It gives directions for constructing apparatus and for applying the fumigating gases, embodying the experience of the author as well as of others in the successful application of these methods. The subjects treated cover orchard and nursery fumigation, applications in greenhouses and hotbeds, use in mills, warehouses, elevators, ships, cars, houses and other places. It tells how to destroy insects in orchards, greenhouses, in stored grain and seeds, how to protect woolens, rugs and furs; in short, all ways in which fumigation may be used. Each topic is presented in a clear, popular style, and the illustrations add largely to the value of the work.

IRRIGATION IN THE UNITED STATES.—A most complete and careful treatment of this subject which is of such growing importance. By Frederick H. Newell, chief of the Division of Hydrography of the United States Geological Survey. Cloth, 400 pp. Profusely illustrated. Thomas Y. Crowell & Co., New York. Price, $2.00 net.

"Home making is the aim of this book; the reclamation of places now waste and desolate, and the creation of fruitful farms, each tilled by its owner, is its object. "To this end attention is directed to the resources of our great western domain and the possibilities of its most complete utilization are discussed.

The book as a whole, is a complete, yet sufficiently popular treatise on irrigation in its various phases, its problems, its possibilities and impossibilities, its advantages and disadvantages.

The various problems of water supply, reservoirs, mains and the methods of water distribution as seen by the practical engineer, are set forth in a clear, accurate manner, yet sufficiently popular for all who may be interested. Methods of irrigation in detail, the lifting and handling of water, the value of artesian and ordinary wells, together with the closely related considerations are carefully treated.

A chapter on irrigation laws, one on the irrigation problems and possibilities of each of the western states and a short discussion of the value of irrigation in humid regions rounds out the work.

The book is profusely illustrated, containing one hundred and forty plates and figures, which add much to the value of the work.

A Gilt Edge Investment

700% Profit

A barrel of Diamond Crystal Salt (280 lbs.) costs about $2.75. It will salt 4,480 lbs. of butter. It adds 1.8 per cent. or 80½ lbs. more weight to the butter than would ordinary salt. With butter at 24c the gain is $19.35, making the profit per barrel of

DIAMOND CRYSTAL SALT

"The Salt that's all Salt"

The only Salt 99.100 per cent. pure

about $16.00, or 700 per cent. on the cost of the salt. The exhaustive experiments and exacting tests of Diamond Crystal Salt by Wisconsin U. S. Agricultural Experiment Station have confirmed this conclusively. However, we are willing that you make the practical test yourself. It does not require an expert to determine the superiority of Diamond Crystal Salt. Write and we will send a FREE SAMPLE BAG.

Diamond Crystal Salt Co.,

ST. CLAIR, MICH.

Very Low Rates

FOR

COLONISTS

TO

California, Montana, Utah, Washington, Oregon, British Columbia, Idaho,

VIA

Big Four Route

One way second class colonist tickets to Helena, Butte, Ogden, Spokane, Portland, Tacoma, Seattle, San Francisco, Los Angeles, San Jose, and other points in the West and Northwest will be on sale at very low rates from all points on the "Big Four," daily, until April 30, 1902.

For full information and particulars as to rates, tickets, limits, etc., call on Agents "Big Four Route," or address the undersigned.

WARREN J. LYNCH, Gen'l Pass. & Ticket Agt.

W. P. DEPPE, Asst. G. P. & T. A.

CINCINNATI, O.

AN ACRE OF CORN

and its possibilities under the Silage system—being the theme of

"A BOOK ON SILAGE"

By Prof. F. W. WOLL

of the University of Wisconsin. Revised and up-to-date, neatly bound into a volume of 234 pages. It embraces full information from planting to feeding the crop, and includes working plans and specifications for building all silos. Also embraces:

I—Silage Crops. II—Silos.
III—Silage. IV—Feeding of Silage.
V—Comparison of Silage and other Feeds.
VI—The Silo in Modern Agriculture,

And illustrations and complete plans for round and rectangular silos, dairy barns, tables of compounded rations, etc. **Mailed for 10c.** coin or stamps.

SILVER MFG. CO.
Salem, Ohio.